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Effect of Foliar Application of Micronutrients and Methanol on Seed Yield of Soybean

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A B S T R A C T

A field experiment was conducted to study the effect of foliar application of micronutrients and methanol on seed yield of soybean involving four chemical spray *viz.*, Control, FeSO4 @ 0.50%, ZnSO4 @ 0.25% and Methanol @ 20% (v/v)] and six genotypes *viz.*, Kalitur, Birsa soya, JS-9305, JS-335, JS-71-05 and Co-1 with 24 treatment combinations at the Water and Land Use Management Institute (WALMI) Farm, UAS, Dharwad during 2012 and 2013. The experiment results of pooled data revealed that, $FeSO_4$ @ 0.50% foliar application recorded higher plant height at 90 DAS (58.16 cm), number of branches at 90 DAS (5.42) and number of trifoliate leaves at 60 DAS (19.35) compared to control. Seed yield and its components revealed the marked variations among the foliar application of micronutrients and methanol during the study. The maximum number of pods (50.81), pod length (4.09 cm), number of seeds per pod (3.20), seed yield per plant (21.78 g), seed yield (22.49 q/ha) and seed recovery (79.06%) were observed in plants sprayed with $FeSO_4$ @ 0.50% compared to control. Among the genotypes, Kalitur genotype registered higher plant height at 90 DAS (61.23 cm), number of trifoliate leaves at 60 DAS (21.22) and whereas higher number of branches per plant (5.50) recorded in JS-9305 compared to other genotypes. However in, seed yield and its yield attributing parameters JS-335 recorded significantly higher number of seeds per pod (3.28), pod length (4.05 cm) followed by JS-9305 (3.26 and 4.26 cm, respectively). The higher number of pods per plant (51.72), seed yield per plant (22.47 g), seed yield per ha (23.45 q) and seed recovery (79.83%) were observed in JS-335.

Introduction

Soybean is one of the world's most versatile and fascinating crops and is recognized as the important oil seed in the world in terms of total production and international trade. In last 30 years soybean revolution and transformed into an export oriented crop. To enhance the production potential of this crop, application of micronutrients in little quantity is necessary for normal growth of the crop plants. Lack of these elements causes the plants to suffer from physiological stresses caused by several enzymatic and other metabolic functions. Various ill responses were observed in growth and yield in crop cultivars due to deficiency of these elements.

Among the various micronutrients, iron and zinc are most important elements. Iron and

Zinc take over different roles in crop, such as formation, partitioning and utilization of photosynthesis assimilates [1]. Iron is a cofactor for approximately 140 enzymes that catalyze unique biochemical reactions. Hence, iron has many essential roles in plant growth and development including chlorophyll synthesis, thylakoid synthesis, chloroplast development and it is critical element in electron transport chain in photosystems. Zinc is main composition of ribosomes and it is essential for production of amino acids and proteins. It is known to have an important role either as metal component of enzymes or as a functional, structural or regulatory cofactors of large number of enzymes. Foliar applied micronutrients at critical stages of the crop were effectively absorbed by the sources and then translocated to the developing sinks, producing more number of pods and better filling of seeds in crops [2].

Application of organic solvents is an approach for increasing carbon dioxide concentration in crops [3]. Recent investigation showed that the C3 crops have shown the increased growth and yield by application of methanol which acts as a source of carbon for these crops. Generally, the major role of methanol is to prevent negative effect of stresses on crops through reduction of photo respiration. When applied, methanol enters the plant tissues rapidly and influence on plant carbon metabolism [4]. with this background, the present investigation was carried out with objective of enhancing the seed yield of soybean with foliar applications of micronutrient and methanol.

Materials and Methods

The experiment was laid out in RCBD with factorial concept in three replications at the Water and Land Use Management Institute (WALMI) Farm, UAS, Dharwad during 2012 and 2013.The treatments were four chemical spray *viz.*, C_1: Control, C_2: $FeSO_4$ @ 0.50%, C_3: $ZnSO_4$ @ 0.25% and C_4: Methanol @ 20% (v/v) and six genotypes *viz.*, G_1: Kalitur, G_2: Birsa soya, G_3: JS-9305, G_4: JS-335, G_5: JS-71-05 and G_6: Co-1. The micronutrients and methanol foliar spray were sprayed at flowering stage of the crop growth period. In order to measure parameters, five plants were selected randomly from each pot at different stages of crop growth. Following growth, seed yield and yield attributing parameters *viz.*, plant height, number of branches, number of trifoliate leaves, number of pods, pod length, number of seeds per pod, seed yield per plant, seed yield and seed recovery percentage were recorded for each sample according to standard protocols and results are analysed through statistical procedure.

Results and Discussion

The various factors are known to influence on the growth and yield of soybean, amongst them nutrient management plays an important and vital role. Presently, the chemical fertilizers are considered as the major source of nutrients. However, apart from major nutrients, micronutrients such as iron, zinc and organic solvent like methanol play critical role in the production of quality seed. With deficiency of iron and zinc elements in our experimental site it drew attention for applying foliar application of these micronutrients for increasing soybean crop production.

Influence of chemical spray on growth, seed yield and yield attributes

In the present study, the foliar application of chemical was found to be non-significant with respect to plant height at all stages of crop growth whereas, number of branches at 90 DAS and number of leaves at 60 DAS during 2012 and 2013 exhibited significant results

and are presented in Table 1. From the results of the pooled data, it was observed that foliar spray of $FeSO_4$ @ 0.50% (C_2) recorded relatively higher plant height at 90 DAS (58.16 cm), significantly maximum number of branches at 90 DAS (5.42) and number of trifoliate leaves at 60 DAS (19.35) followed by $ZnSO_4$ @ 0.25% (C_3) compared to control (56.23, 4.48 and 18.19 respectively). These results indicated that iron and zinc application showed marked response on these growth parameters. This may be related to effect of foliar application of iron at the time of flowering resulted in positive effect on biochemical and physiological process and its stimulating effect on photosynthetic pigment and enzymatic activity which in turn encourage vegetative growth of plant [5-6].

The foliar application of chemicals showed significant differences on seed yield and yields attributes during 2012 and 2013 and are presented in Tables 2, 3 and 4. From the results of the pooled data, maximum number of pods (50.81), pod length (4.09 cm), number of seeds per pod (3.20), seed yield per plant (21.78 g), seed yield (22.49 q/ha) and seed recovery (79.06%) were observed in plants sprayed with $FeSO_4$ @ 0.50% (C_2) followed by $ZnSO_4$ @ 0.25% (C_3) (49.82, 3.87 cm 3.08, 28.69 g, 4.23 kg, 21.13 q/ha and 78.39%, respectively) compared to control (45.82, 3.82 cm, 2.89, 16.76 g, 18.84 q/ha and 77.98%, respectively). About 11.94 per cent increase in seed yield per hectare was noticed with $FeSO_4$ @ 0.50% (C_2) treatment over control. The significant increase in seed yield and yield attributes obtained with the application of chemical spray may be attributed to more number of productive branches per plant, higher number of pods per plant, seeds per pod and greater yield attributes through higher photosynthetic assimilates and their translocation to sink contribute for higher seed yield. Further, micronutrient and methanol application influence the enzymatic activity and carbon cycle in plants with higher carbon dioxide fixation. It is also noticed that foliar application of micronutrients and methanol at flowering stage in the present investigation resulted in enhanced yield attributing parameters; this may be due to effect of these chemicals on reproductive organs [7-8].

Influence of genotypes on growth, seed yield and yield attributes

The plant growth, flowering, seed yield and quality parameters are greatly influenced by genetic makeup of the varieties besides, several biotic, abiotic, agronomic and management practices. In the present study, genotypic differences with respect to field performance have been noticed in soybean.

In general Kalitur (G_1) genotype registered the highest plant height (61.23 cm) at 90 DAS. It may be mainly due to efficient accumulation of photosynthates in the vegetative plant parts. Likewise, the numbers of trifoliate leaves were significantly influenced due to genotypes during 2012 and 2013 and are presented in Table 1. From results of the pooled data, it was showed that significantly maximum number of trifoliate leaves were recorded (21.22) in Kalitur (G_1) compared to JS-9305(G_3) which recorded minimum number of trifoliate leaves (16.80) at 60 DAS. From these results, it was found that all the genotypes differed significantly for growth parameters due to their genetic differences [9-11].

In the present study, significant differences were recorded among the soybean genotypes with respect to number of pods, pod length, number of seeds per pod, seed yield per plant, seed yield per ha and seed recovery percentage irrespective of chemical spray during 2012 and 2013 and are presented in Tables 2, 3 and 4.

Table.1 Effect of micronutrients and methanol application on plant height (cm), number of trifoliate leaves and number of branches per plant in soybean genotypes

Treatments	Plant height (cm) at 90DAS			Number of trifoliate leaves at 60DAS			Number of branches per plant at 90DAS		
	2012	2013	Pooled	2012	2013	Pooled	2012	2013	Pooled
Chemical spray (C):									
C_1: Control	55.50	56.97	56.23	18.23	18.14	18.19	4.67	4.50	4.58
C_2: 0.50% $FeSO_4$	57.86	58.47	58.16	19.24	19.46	19.35	5.39	5.44	5.42
C_3: 0.25% $ZnSO_4$	56.60	57.74	57.17	18.77	18.74	18.76	5.22	4.89	5.06
C_4: 20 % Methanol (v/v)	56.51	57.36	56.94	19.21	19.37	19.29	5.06	4.78	4.92
S.Em±	0.66	0.98	0.69	0.23	0.30	0.19	0.17	0.18	0.14
CD (p=0.05)	NS	NS	NS	0.65	0.86	0.55	0.48	0.52	0.41
Genotypes (G):									
G_1: Kalitur	60.72	61.74	61.23	21.71	20.74	21.22	4.92	5.33	5.13
G_2: Birsa soya	59.20	61.31	60.25	19.90	20.24	20.07	4.75	4.42	4.58
G_3: JS-9305	59.60	61.73	60.67	17.03	16.58	16.80	5.67	5.33	5.50
G_4: JS-335	60.48	60.96	60.72	17.16	17.54	17.35	5.25	5.08	5.17
G_5: JS-71-05	48.87	48.92	48.89	18.60	19.38	18.99	5.00	4.50	4.75
G_6: Co-1	50.84	51.15	51.00	18.78	19.09	18.93	4.92	4.75	4.83
S.Em±	0.81	1.20	0.85	0.28	0.37	0.23	0.20	0.22	0.17
CD (p=0.05)	2.32	3.44	2.43	0.79	1.06	0.67	0.59	0.63	0.50
Interactions (C x G):									
C_1G_1	60.87	61.03	60.95	21.23	18.33	19.78	4.33	4.67	4.50
C_1G_2	58.13	60.30	59.22	19.30	19.63	19.47	4.00	4.33	4.17
C_1G_3	58.33	61.13	59.73	16.77	16.63	16.70	5.67	5.00	5.33
C_1G_4	59.73	60.73	60.23	16.23	16.87	16.55	4.67	4.67	4.67
C_1G_5	47.13	48.27	47.70	18.20	18.87	18.53	4.33	4.00	4.17
C_1G_6	48.80	50.33	49.57	17.67	18.53	18.10	5.00	4.33	4.67
C_2G_1	61.70	62.67	62.18	22.40	22.00	22.20	5.33	5.67	5.50
C_2G_2	60.36	62.23	61.30	20.47	21.10	20.79	4.33	4.33	4.33
C_2G_3	60.60	62.07	61.33	17.33	16.50	16.92	6.33	6.67	6.50
C_2G_4	61.47	61.35	61.41	17.33	17.83	17.58	5.67	5.67	5.67
C_2G_5	51.37	50.00	50.69	18.67	19.50	19.08	5.33	4.67	5.00
C_2G_6	51.67	52.48	52.08	19.22	19.80	19.51	5.33	5.67	5.50
C_3G_1	59.36	61.47	60.41	21.38	20.87	21.12	5.00	5.33	5.17
C_3G_2	59.80	61.80	60.80	20.17	19.83	20.00	5.33	4.67	5.00
C_3G_3	60.04	62.00	61.02	16.43	16.17	16.30	5.33	4.67	5.00
C_3G_4	60.47	60.47	60.47	17.27	17.33	17.30	5.33	5.33	5.33
C_3G_5	49.10	49.00	49.05	18.47	19.50	18.98	5.33	4.67	5.00
C_3G_6	50.83	51.73	51.28	18.89	18.77	18.83	5.00	4.67	4.83
C_4G_1	60.95	61.80	61.37	21.81	21.77	21.79	5.00	5.67	5.33
C_4G_2	58.50	60.90	59.70	19.67	20.40	20.03	5.33	4.33	4.83
C_4G_3	59.44	61.72	60.58	17.60	17.00	17.30	5.33	5.00	5.17
C_4G_4	60.23	61.30	60.77	17.80	18.13	17.97	5.33	4.67	5.00
C_4G_5	47.87	48.40	48.13	19.07	19.67	19.37	5.00	4.67	4.83
C_4G_6	52.07	50.07	51.07	19.33	19.27	19.30	4.33	4.33	4.33
Mean	56.62	57.64	57.13	18.86	18.93	18.90	5.08	4.90	4.99
S.Em±	1.63	2.41	1.70	0.55	0.73	0.47	0.41	0.44	0.35
CD (p=0.05)	NS	NS	NS	NS	NS	NS	NS	NS	NS

NS: Non Significant

Table.2 Effect of micronutrients and methanol application on number of pods per plant and pod length (cm) of soybean genotypes

Treatments	Number of pods per plant			Pod length (cm)		
	2012	2013	Pooled	2012	2013	Pooled
Chemical spray (C):						
C_1: Control	45.78	45.86	45.82	3.84	3.80	3.82
C_2: 0.50% $FeSO_4$	50.54	51.08	50.81	4.08	4.10	4.09
C_3: 0.25% $ZnSO_4$	49.37	50.28	49.82	3.86	3.88	3.87
C_4: 20 % Methanol (v/v)	48.43	48.46	48.44	3.84	3.82	3.83
S.Em±	0.87	0.81	0.66	0.04	0.03	0.02
CD (p=0.05)	2.50	2.32	1.89	0.11	0.09	0.07
Genotypes (G):						
G_1: Kalitur	48.63	49.00	48.82	3.71	3.70	3.70
G_2: Birsa soya	48.97	48.68	48.83	3.83	3.80	3.82
G_3: JS-9305	46.42	47.18	46.80	4.22	4.29	4.26
G_4: JS-335	51.48	51.95	51.72	4.04	4.07	4.05
G_5: JS-71-05	47.70	48.02	47.86	3.85	3.80	3.82
G_6: Co-1	47.98	48.68	48.33	3.79	3.73	3.76
S.Em±	1.064	0.987	0.80	0.05	0.04	0.03
CD (p=0.05)	3.058	2.837	2.31	0.14	0.10	0.08
Interactions (C x G):						
C_1G_1	44.73	44.07	44.40	3.51	3.47	3.49
C_1G_2	44.80	45.33	45.07	3.85	3.77	3.81
C_1G_3	43.60	43.47	43.53	4.24	4.27	4.26
C_1G_4	50.33	49.67	50.00	3.98	4.01	4.00
C_1G_5	45.07	44.87	44.97	3.74	3.63	3.69
C_1G_6	46.13	47.73	46.93	3.72	3.61	3.67
C_2G_1	50.40	51.00	50.70	3.91	3.97	3.94
C_2G_2	51.67	51.27	51.47	3.97	3.91	3.94
C_2G_3	48.13	48.33	48.23	4.48	4.51	4.50
C_2G_4	54.00	55.67	54.83	4.22	4.25	4.24
C_2G_5	49.40	51.20	50.30	3.96	3.99	3.98
C_2G_6	49.63	49.03	49.33	3.94	3.97	3.96
C_3G_1	50.07	51.80	50.93	3.79	3.71	3.75
C_3G_2	50.80	49.93	50.37	3.71	3.73	3.72
C_3G_3	46.93	48.93	47.93	4.11	4.35	4.23
C_3G_4	51.27	52.13	51.70	4.06	4.08	4.07
C_3G_5	48.33	48.80	48.57	3.78	3.75	3.77
C_3G_6	48.80	50.07	49.43	3.72	3.65	3.69
C_4G_1	49.33	49.13	49.23	3.62	3.66	3.64
C_4G_2	48.60	48.20	48.40	3.78	3.81	3.80
C_4G_3	47.00	48.00	47.50	4.06	4.03	4.05
C_4G_4	50.33	50.33	50.33	3.88	3.91	3.90
C_4G_5	48.00	47.20	47.60	3.91	3.82	3.87
C_4G_6	47.33	47.87	47.60	3.77	3.66	3.72
Mean	48.53	48.92	48.72	3.89	3.91	3.90
S.Em±	2.13	1.97	1.61	0.10	0.07	0.07
CD (p=0.05)	NS	NS	NS	NS	NS	NS

NS: Non Significant

Table.3 Effect of micronutrients and methanol application on number of seeds per pod and seed yield per plant (g) of soybean genotypes

Treatments	Number of seeds per pod			Seed yield per plant (g)		
	2012	2013	Pooled	2012	2013	Pooled
Chemical spray (C):						
C_1: Control	2.86	2.93	2.89	16.46	17.06	16.76
C_2: 0.50% $FeSO_4$	3.17	3.23	3.20	21.32	22.24	21.78
C_3: 0.25% $ZnSO_4$	3.04	3.11	3.08	19.50	20.71	20.11
C_4: 20 % Methanol (v/v)	3.03	3.10	3.07	18.97	19.58	19.28
S.Em±	0.04	0.05	0.04	0.43	0.48	0.31
CD (p=0.05)	0.12	0.16	0.11	1.23	1.37	0.88
Genotypes (G):						
G_1: Kalitur	3.15	3.20	3.18	18.80	19.26	19.03
G_2: Birsa soya	2.82	2.85	2.83	20.15	20.37	20.26
G_3: JS-9305	3.21	3.30	3.26	19.75	20.90	20.33
G_4: JS-335	3.22	3.33	3.28	21.34	23.60	22.47
G_5: JS-71-05	3.05	3.15	3.10	16.89	17.41	17.15
G_6: Co-1	2.70	2.73	2.72	17.46	17.85	17.65
S.Em±	0.05	0.07	0.05	0.52	0.59	0.38
CD (p=0.05)	0.15	0.19	0.14	1.50	1.68	1.08
Interactions (C x G):						
C_1G_1	3.00	3.13	3.07	16.04	16.42	16.23
C_1G_2	2.67	2.67	2.67	16.90	17.58	17.24
C_1G_3	3.00	3.07	3.03	16.54	17.03	16.78
C_1G_4	3.07	3.20	3.13	19.30	21.28	20.29
C_1G_5	3.00	3.07	3.03	15.61	15.33	15.47
C_1G_6	2.40	2.47	2.43	14.38	14.72	14.55
C_2G_1	3.33	3.40	3.37	21.06	21.64	21.35
C_2G_2	2.93	3.00	2.97	22.34	22.28	22.31
C_2G_3	3.27	3.27	3.27	21.91	23.08	22.50
C_2G_4	3.40	3.47	3.43	24.53	26.74	25.63
C_2G_5	3.20	3.27	3.23	18.75	19.61	19.18
C_2G_6	2.87	3.00	2.93	19.29	20.10	19.70
C_3G_1	3.20	3.13	3.17	19.91	20.23	20.07
C_3G_2	2.87	3.00	2.93	20.79	20.72	20.76
C_3G_3	3.26	3.20	3.23	19.33	21.28	20.31
C_3G_4	3.20	3.47	3.33	21.41	24.43	22.92
C_3G_5	3.00	3.20	3.10	16.86	18.09	17.47
C_3G_6	2.73	2.67	2.70	18.73	19.50	19.11
C_4G_1	3.07	3.13	3.10	20.55	20.90	20.73
C_4G_2	2.80	2.73	2.77	17.44	17.05	17.25
C_4G_3	3.33	3.67	3.50	21.20	22.23	21.71
C_4G_4	3.20	3.20	3.20	20.12	21.94	21.03
C_4G_5	3.00	3.07	3.03	16.32	16.62	16.47
C_4G_6	2.80	2.80	2.80	18.20	18.75	18.48
Mean	3.03	3.09	3.06	19.06	19.90	19.48
S.Em±	0.10	0.13	0.09	1.05	1.17	0.75
CD (p=0.05)	NS	NS	NS	NS	NS	NS

NS: Non significant

Table.4 Effect of micronutrients and methanol application on seed yield per hectare (q) and seed recovery percentage of soybean genotypes

Treatments	Seed yield per hectare (q)			Seed recovery (%)		
	2012	2013	Pooled	2012	2013	Pooled
Chemical spray (C):						
C_1: Control	18.16	19.53	18.84	78.05	77.91	77.98
C_2: 0.50% $FeSO_4$	22.34	22.64	22.49	78.97	79.15	79.06
C_3: 0.25% $ZnSO_4$	20.37	21.88	21.13	78.31	78.48	78.39
C_4: 20 % Methanol (v/v)	20.11	21.33	20.72	78.15	78.24	78.20
S.Em±	0.76	0.67	0.45	0.21	0.22	0.13
CD (p=0.05)	2.17	1.90	1.30	0.60	0.63	0.36
Genotypes (G):						
G_1: Kalitur	19.37	22.37	20.87	78.36	78.41	78.39
G_2: Birsa soya	22.47	21.58	22.02	77.14	77.23	77.19
G_3: JS-9305	23.10	22.43	22.76	77.65	77.84	77.74
G_4: JS-335	24.23	22.67	23.45	79.81	79.84	79.83
G_5: JS-71-05	19.24	22.64	20.94	78.48	78.61	78.55
G_6: Co-1	13.06	16.38	14.72	78.77	78.74	78.75
S.Em±	0.93	0.82	0.55	0.26	0.27	0.15
CD (p=0.05)	2.66	2.33	1.58	0.74	0.77	0.44
Interactions (C x G):						
C_1G_1	18.87	20.48	19.68	77.86	77.97	77.91
C_1G_2	19.98	20.83	20.40	76.44	76.05	76.25
C_1G_3	18.82	19.63	19.23	77.54	77.73	77.63
C_1G_4	23.22	22.17	22.70	79.26	79.22	79.24
C_1G_5	16.63	18.52	17.57	78.23	78.17	78.20
C_1G_6	11.43	15.52	13.47	78.98	78.32	78.65
C_2G_1	20.98	23.43	22.21	79.24	79.25	79.24
C_2G_2	26.32	23.03	24.68	77.64	77.79	77.72
C_2G_3	26.79	23.37	25.08	77.75	77.99	77.87
C_2G_4	24.75	23.10	23.93	80.95	81.13	81.04
C_2G_5	21.04	25.50	23.27	78.94	79.18	79.06
C_2G_6	14.15	17.40	15.78	79.28	79.59	79.43
C_3G_1	19.85	22.30	21.07	78.15	78.19	78.17
C_3G_2	21.98	20.92	21.45	77.47	77.84	77.66
C_3G_3	22.50	24.58	23.54	77.65	77.89	77.77
C_3G_4	24.71	22.65	23.68	79.27	79.46	79.37
C_3G_5	19.65	24.43	22.04	78.84	78.84	78.84
C_3G_6	13.57	16.42	14.99	78.47	78.63	78.55
C_4G_1	17.77	23.27	20.52	78.20	78.25	78.22
C_4G_2	21.60	21.53	21.57	77.01	77.25	77.13
C_4G_3	24.31	22.12	23.21	77.64	77.74	77.69
C_4G_4	24.22	22.77	23.49	79.77	79.55	79.66
C_4G_5	19.65	22.10	20.87	77.92	78.27	78.10
C_4G_6	13.11	16.17	14.64	78.34	78.41	78.38
Mean	20.24	21.34	20.79	78.37	78.45	78.41
S.Em±	1.86	1.63	1.11	0.52	0.54	0.31
CD (p=0.05)	NS	NS	NS	NS	NS	NS

NS: Non Significant

Results of the pooled data, JS-335 (G_4) recorded significantly higher number of seeds per pod (3.28), pod length (4.05) followed by JS-9305(G_3) (3.26 and 4.26, respectively). Whereas, higher number of pods per plant (51.72), seed yield per plant (22.47 g), seed yield per ha (23.45 q) and seed recovery (79.83%) were observed in JS-335. The differences on seed yield and yield attributes observed among the genotypes in the present study may be attributed to their differences in growth habit and genetic potential [12-13].

The interaction effect between chemical spray and genotypes showed non- significant variations for all growth, seed yield attributing and seed quality parameters during 2012 and 2013 are presented in Tables 2, 3 and 4. However, from results of the pooled data, higher growth parameters such as plant height (62.18 cm), number of branches (6.50), number of trifoliate leaves (22.20) were observed in C_2G_1, C_2G_3 and C_2G_1 respectively compared to other treatment combination. While, in yield attributing characters like higher number of pods per plant (54.83), higher number of seeds per pod (3.42) and seed recovery (81.04%) were recorded in C_2G_4 whereas higher pod length (4.50 cm) and seed yield per hectare (25.08 q) in C_2G_3.

In conclusion, foliar application of micronutrients and methanol treatments found significant effect on growth and seed yield components of soybean genotypes. Among the different chemical spray $FeSO_4$ @ 0.50% and in genotypes JS-335 found effective in increasing the seed yield and its components.

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